Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Petition of The Boeing Company for	)	RM-11773
Allocation and Authorization of Additional	)	
Spectrum for the Fixed-Satellite Service in the	)	
50.4-51.4 GHz and 51.4-52.4 GHz Bands	)	

RESPONSE OF THE BOEING COMPANY

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SUMMARY

Boeing's Petition urges the Commission to allocate and authorize additional spectrum for the fixed-satellite service ("FSS") in the 50.4-51.4 GHz and 51.4-52.4 GHz ("50 GHz") bands. In its Petition, Boeing demonstrates a clear and immediate need for next generation broadband satellite systems to bring 5G advanced communications services to all Americans, and how these services can coexist with terrestrial services in the same spectrum.

Boeing's Petition is exceedingly timely, as the Commission's Spectrum Frontiers proceeding considers the future of the millimeter wave ("mmW") bands and expressly seeks input on the spectrum sharing opportunities between the newly created Upper Microwave Flexible Use Service ("UMFUS") and satellite services in the V-band. The satellite industry has, with the Commission's endorsement, made preparations over decades to use V-band spectrum for broadband satellite services as soon as mmW technology became commercially feasible. Boeing has decades of experience designing and constructing V-band satellite systems for the U.S. government. This technology is now suitable for commercial use, and requires a full 5 GHz of paired spectrum necessary to serve customers nationwide, including those that remain unserved or underserved by terrestrial broadband options.

Boeing has shown that FSS can share the 50 GHz band with UMFUS on a fully cooperative basis. By siting its individually licensed satellite earth stations only in rural areas, Boeing has demonstrated that their operation would likely affect UMFUS service to only about 0.1 percent of the U.S. population. This approach is consistent with the Commission's longstanding co-primary allocation, as well as the statutory requirements and administrative goals of promoting highly efficient spectrum sharing between different services and competitors. It is also consistent with the comments of wireless industry members, who have acknowledged

that the characteristics of mmW propagation and use cases enable spectrum sharing and coordination strategies that do not require exclusivity between services.

Finally, Boeing's Petition to allocate and authorize additional FSS spectrum in the 50 GHz band is necessary and appropriate to complement downlink satellite operations in the 37.5-40.0 ("37/39") GHz bands. As Boeing has demonstrated, opportunistic satellite operation is possible in the 37/39 GHz band without the need for protection from UMFUS. Boeing has also shown the significant spectrum requirements of high speed nationwide satellite broadband, which justify Boeing's proposal for a full 5 GHz of paired V-band spectrum.

Boeing therefore urges the Commission to adopt the proposed FSS allocation in the 51.4-52.4 GHz band and modify Section 25.202 of its rules to identify the 50.4-51.4 GHz band as available for FSS Earth-to-space operations. The Commission should adopt these spectrally-efficient measures in the context of its concurrently pending Spectrum Frontiers proceeding.

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To: The Commission

RESPONSE OF
THE BOEING COMPANY

The Boeing Company ("Boeing") hereby responds to the comments and oppositions that were filed addressing its petition for rulemaking ("Petition") to allocate and authorize additional spectrum for the fixed-satellite service ("FSS") in the 50.4-51.4 GHz and 51.4-52.4 GHz ("50 GHz") bands.[1] As Boeing explained in its Petition, additional spectrum is needed for FSS to enable the next generation of broadband satellite systems to use the V-band to provide very high data rate "5G" services to consumers that can fully bridge the broadband digital divide.[2] Boeing's position in this regard was strongly supported by major participants in the satellite communications industry, including by its two major organizations, the Satellite Industry Association and the Global VSAT Forum.[3]

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[1] *See* 47 C.F.R. § 1.405(b); Public Notice, *Consumer & Governmental Affairs Bureau, Reference Information Center, Petition For Rulemaking Filed*, Report No. 3051 (Sept. 16, 2016).

[2] *See* Petition of The Boeing Company for Allocation and Authorization of Additional Spectrum for the Fixed-Satellite Service in the 50.4-51.4 GHz and 51.4-52.4 GHz Bands, RM-11773, at 5-9 (June 22, 2016) ("*Petition*").

[3] *See* Comments of the Satellite Industry Association, RM-11773 (Oct. 17, 2016); Comments of the Global VSAT Forum, RM-11773 (Oct. 17, 2016); Comments of EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC, RM-11773 (Oct. 17, 2016); Comments of ViaSat, Inc., RM-11773 (Oct. 17, 2016).

Boeing's Petition was intended to complement the Commission's ongoing Spectrum Frontiers proceeding by identifying additional opportunities for spectrum sharing between future terrestrial 5G services and broadband satellite systems. Boeing therefore supports the comments of those parties that urge the Commission to incorporate Boeing's Petition into the record of the Spectrum Frontiers proceeding.

I. BOEING'S PETITION CONSTITUTES A CONCRETE AND FULLY JUSTIFIED PROPOSAL TO IDENTIFY ADDITIONAL UPLINK SPECTRUM FOR FSS IN THE V-BAND

Boeing has demonstrated a clear and immediate need both for next generation broadband satellite systems to bring "5G" advanced communications services to all Americans, and for access to a full 5 GHz of paired V-band spectrum to ensure that these broadband services fulfill the aggregate capacity and data throughput requirements of consumers.[4] Despite the timeliness and relevance of Boeing's Petition, CTIA and others describe Boeing's proposal as "speculative,"[5] "premature,"[6] "frivolous and repetitive,"[7] and "without basis or justification."[8]

Boeing's Petition is obviously not premature. Boeing filed its Petition in the months before the Commission adopted its Further Notice of Proposed Rulemaking in its Spectrum Frontiers proceeding, which expressly considers the spectrum sharing opportunities that exist between its newly created Upper Microwave Flexible Use Service ("UMFUS") and satellite

[4] *See* Further Notice Comments of The Boeing Company, GN Docket No. 14-177, *et al.*, at 4-16 (Sept. 30, 2016) ("*Boeing Further Notice Comments*").

[5] Opposition to Petition for Rulemaking of CTIA, RM-11773, at 1, 2 and 5 (Oct. 17, 2016) ("*CTIA Opposition*").

[6] *Id.* at 5; Opposition to Petition for Rulemaking of Straight Path, RM-11773, at 1-4 (Oct. 17, 2016) ("*Straight Path Opposition*").

[7] *CTIA Opposition* at 5.

[8] *Id.* at 1.

services in the V-band.[9] CTIA appears to suggest that Boeing should have withheld its Petition until after the rulemaking proceeding had concluded, but that would not have contributed to a robust record in the Spectrum Frontiers proceeding, or to the furtherance of reasoned decision making by the Commission in reaching its conclusions.

It is also inappropriate for CTIA to claim that Boeing's Petition is frivolous or repetitive "with respect to past FSS advocacy in the Spectrum Frontiers proceeding."[10] Boeing acknowledges that the satellite industry has asserted throughout the Spectrum Frontiers proceeding (and in the decades previous) that the broadband satellite industry requires robust access to the V-band, including access to the 50 GHz band. Boeing's Petition is consistent with and supplements these longstanding arguments. Given that the Commission has made no ruling on whether the public interest would be served by allowing satellite systems to share the 50 GHz band with UMFUS, no basis exists to claim that Boeing's Petition warrants dismissal as frivolous or repetitive with longstanding satellite industry advocacy.

CTIA is also incorrect in claiming that Boeing's Petition is speculative or without basis or justification. The tremendous growth in demand for high speed broadband has been well documented and acknowledged by the Commission. In addition, no party has questioned the unique ability of satellite communications systems to bring broadband to all consumers on an equitable basis regardless of their location.

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[9] *See* Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, GN Docket No. 14-177, *et al.*, Report and Order and Further Notice of Proposed Rulemaking, FCC 16-89 (July 14, 2016) ("*Report and Order*" or "*Further Notice*").

[10] *CTIA Opposition* at 5.

CTIA challenges the satellite industry's need for additional FSS spectrum, vaguely referencing legacy FSS spectrum allocations in frequency bands as high as 80 GHz.[11] CTIA, however, provides no context with respect to whether such bands are usable for broadband satellite services given current technology or the spectrum sharing challenges that exist with respect to certain frequency bands. CTIA also accuses the satellite industry of engaging in a "land rush" for spectrum.[12] CTIA disregards the fact that the satellite industry has, with the Commission's endorsement, made preparations over decades to use V-band spectrum for broadband satellite services as soon as millimeter wave ("mmW") technology becomes commercially feasible.

Boeing, for example, has spent decades designing and constructing V-band satellite systems for the U.S. Government and has been developing its commercial V-band satellite system for several years. Boeing requested Commission authority to launch its satellite system only after confirming the technical and commercial validity of its proposal. In stark contrast, the Spectrum Frontiers proceeding focuses on about ten different spectrum bands for future terrestrial services based not on their actual need to support specific wireless applications, but on their availability for potential future development. Such an approach arguably does constitute a land rush and suitably warrants the "Frontiers" moniker of the 5G proceeding.

T-Mobile argues that Boeing must explain how its proposal is consistent with "actions the Commission has proposed and has already taken" in the Spectrum Frontiers proceeding.[13] The Commission's Spectrum Frontiers proceeding, however, was never solely about terrestrial

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[11] *See id.* at 7.

[12] *Id.* at 4.

[13] Comments of T-Mobile, Inc., RM-11773, at 2 and 5 (Oct. 17, 2016) ("*T-Mobile Comments*").

5G services above 24 GHz. The proceeding was intended to expressly address the adoption of rules "that will allow these bands to be shared with a variety of other uses, including fixed, satellite, and Federal government uses."[14] Boeing's proposal is fully consistent with Commission efforts to identify spectrum that can be shared between terrestrial and satellite services for the benefit of all consumers, including spectrum within the 50 GHz band.

In this regard, T-Mobile acknowledges the need for more spectrum to serve the burgeoning broadband requirements of consumers.[15] T-Mobile claims, however, that "broadband services provided by satellite will be impactful to an important, but very limited segment of the population."[16] T-Mobile seems to presume that satellite-delivered broadband services will be consumed only by populations in rural and remote locations. T-Mobile is correct in acknowledging that these populations are an important and statutorily-mandated target for broadband communications services. T-Mobile is incorrect, however, in characterizing the broadband needs of these populations as a "very limited" market segment,[17] particularly given the fact that rural and remote areas span most of this country. Consumers in rural and remote areas have broadband speed and throughput requirements that are equivalent to their urban counterparts, yet for too long terrestrial providers have served them as an afterthought.

Further, Boeing and other satellite operators are designing satellite systems that can provide very high data rate broadband services to consumers in all locations on a competitive basis with terrestrial distribution technologies. Fulfilling this competitive role is one of the

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[14] *Report and Order*, ¶ 3.

[15] *See T-Mobile Comments* at 7.

[16] *Id.*

[17] *Id.*

reasons why Boeing and others in the satellite industry require access to a full 5 GHz of paired spectrum in the V-band. Thus, rather than serving a small market segment, the target market for satellite-delivered broadband is arguably much larger than the market for terrestrial wireless services, potentially including every consumer in the United States and globally.

All this said, Boeing has amply demonstrated that individually licensed satellite systems can easily share the 50 GHz band with UMFUS, rendering irrelevant protestations about the alleged interest within the wireless industry for an UMFUS allocation in this spectrum.

II. BOEING HAS DEMONSTRATED THAT FSS CAN SHARE THE 50 GHZ BAND WITH UMFUS ON A FULLY COOPERATIVE BASIS

As CTIA explains, "[i]n the 50.4-51.4 GHz band, satellite and terrestrial services are co-primary—meaning that both services must work collaboratively to protect each system's operation should the Commission adopt service and licensing rules for the spectrum band."[18] Boeing completely agrees. It is for this reason that Boeing filed detailed comments in this docket and in the Spectrum Frontiers proceeding explaining how cooperative spectrum sharing can occur between UMFUS and individually licensed satellite earth stations in the 50 GHz band.[19]

CTIA, in contrast, contradicts itself in its opposition, arguing at length that "the terrestrial wireless industry has a strong interest in deploying mobile services in the 50.4-52.4 GHz band on

[18] *CTIA Opposition* at 7. CTIA also "encourages Boeing and other FSS providers to work through the Spectrum Frontiers proceeding to provide meaningful sharing criteria and requirements for the 50.4-51.4 GHz band." *Id.* Boeing fully agrees and has worked closely with other companies in the satellite industry to develop meaningful sharing criteria that have been documented in the Spectrum Frontiers proceeding.

[19] *Boeing Further Notice Comments* at 17-23.

a primary, *exclusive-use basis*."[20] Exclusive-use operations in any portion of the 50 GHz band would be incompatible with the co-primary and "collaborative" spectrum sharing that CTIA endorses. Exclusive allocations would also run counter to the statutory requirements and administrative goals of promoting highly efficient spectrum sharing between different services and competitors.

More reasonable positions have been expressed by several 5G proponents in the context of the Spectrum Frontiers proceeding. As Qualcomm explains, the use of a "first come, first serve basis looks to be the most flexible and efficient approach" to assigning site-based priority between UMFUS systems and individually licensed satellite earth stations in the 50 GHz band.[21] Hauwei also supports a coordination approach to spectrum sharing in the 50 GHz band, concluding that "[t]he key to success of sharing among both common and disparate services is the willingness of all parties to take coordinated action to share spectrum assignments."[22]

The Fixed Wireless Communications Coalition ("FWCC") also appears to support "bilateral frequency coordination," but raises questions about whether sufficient incentives would exist to ensure that coordinated systems are actually constructed and operate.[23] FWCC notes that "the highly successful Part 25/Part 101 frequency coordination regime puts strict time limits on licensing after coordination, construction after licensing, and (as to the fixed service)

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[20] *CTIA Opposition* at 9 (*emphasis added*).

[21] Comments of Qualcomm Incorporated, GN Docket No. 14-177, *et al.*, at 9 (Sept. 30, 2016) ("*Qualcomm Further Notice Comments*").

[22] Comments of Huawei Technologies, Inc. (USA) and Huawei Technologies Co., Ltd., GN Docket No. 14-177, *et al.*, at 8 (Sept. 30, 2016) ("*Huawei Further Notice Comments*").

[23] Comments of the Fixed Wireless Communications Coalition, GN Docket No. 14-177, *et al.*, at 8 (Sept. 30, 2016).

loading after construction."[24] FWCC seeks assurance that similar requirements would be adopted for the 50 GHz band[25] and Boeing supports such restrictions.

Boeing further believes that satellite and 5G proponents should work together to forge the details of a coordination approach for the 50 GHz band taking into account the unique opportunities that mmW technologies present to facilitate sharing. As Qualcomm explains, in order to develop coordination requirements between UMFUS and satellite earth stations, consideration should be given to

> the unique characteristics of millimeter wave RF propagation and novel interference conditions these bands experience to enable successful spectrum sharing with satellite operations. For example, the average interference from a millimeter wave mobile handset and associated base station/small cell with a steerable antenna array is quite different from and varies instant to instant when compared to fixed operations in the millimeter wave bands or, for that matter, mobile operations in the sub-3 GHz range.[26]

Another equipment developer, Huawei, appears to concur, explaining "[t]he application of new technologies—beam forming, antennas and power-control, and dynamic operation, for example—will ensure the continuing enablement of new services and opportunities without a universal need for exclusivity in all spectrum assignments."[27]

Therefore, Boeing believes that satellite and 5G proponents can work together to develop a dynamic spectrum sharing approach that could be used to govern the first-in-time coordination process. Using such techniques, individually licensed satellite earth stations in the 50 GHz

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[24] *Id.*

[25] *See id.*

[26] *Qualcomm Further Notice Comments* at 10. Qualcomm explains that it "believes that it may be possible to employ spectrum sharing techniques, such as those discussed []in Section II.D [of Qualcomm's comments], to avoid interference from FSS earth station transmissions." *Id.* at 11.

[27] *Huawei Further Notice Comments* at 8.

band could have a very minimal impact on the potential reach of UMFUS systems. For example, as Boeing has repeatedly explained, Boeing plans to site its satellite earth station gateways only in rural and remote areas of the country where the potential interfering effects of their operation would likely only affect about 0.1 percent of the U.S. population.[28] Such an insignificant impact fully justifies a decision by the Commission to make the 50 GHz band available to both UMFUS and individually licensed satellite earth stations on a co-primary, first-in-time, coordinated basis.

III. THE COMMISSION IS ACTIVELY CONSIDERING APPROPRIATE DOWNLINK SPECTRUM TO MATCH BOEING'S UPLINK SPECTRUM REQUEST

As Straight Path correctly observes, Boeing is seeking access for FSS Earth-to-space operations in the 50 GHz band to match both existing and potentially-available downlink spectrum in the V-band.[29] Straight Path incorrectly claims, however, that use of a portion of this downlink spectrum for satellite services—the 38.6-40.0 ("39") GHz band— "has been superseded by the Report and Order."[30]

The Commission's Report and Order affirmed existing rules that permit the operation of individually licensed satellite earth stations in the 39 GHz band. The accompanying Further Notice also requested comment on opening the 39 GHz band (along with the adjacent 37.5-38.6 ("37") GHz band) to opportunistic use by satellite end user receivers.

Straight Path asserts that the siting restrictions that were adopted in the Report and Order for individually licensed earth stations allow "only limited use of the band for satellite

[28] *See, e.g., Boeing Further Notice Comments* at 19-20.

[29] *See Straight Path Opposition* at 2.

[30] *Id.*

operations."[31] Those siting restrictions, however, appear premised on an assumption that the receiving function of individually licensed earth stations in the 37 and 39 GHz band will require protection from UMFUS. To the extent that such earth stations do not require any protection from UMFUS interference (which Boeing believes may be the case), the siting restrictions may pose no constraint on the placement of individually licensed earth stations in the 37/39 GHz band and possibly should be eliminated.

In any event, all satellite operations in the 37/39 GHz bands—whether limited or not—will require matching uplink spectrum. This can best be accommodated through the identification of the 50.4-51.4 GHz band for FSS in Section 25.202 of the Commission's rules and an allocation for FSS in the 51.4-52.4 GHz band.

Straight Path also references the Commission's decision in the Report and Order to refrain from adopting an FSS downlink operation in the 42.0-42.5 ("42") GHz band.[32] As Straight Path notes, the Commission's decision appears premised on a conclusion that the record before it did not demonstrate a need for additional FSS downlink spectrum.[33] Boeing has since provided extensive comment in response to the Commission's Further Notice documenting the significant spectrum requirements in the V-band for broadband satellite systems to serve the growing needs of the public.[34] Boeing has also explained how FSS end user receivers could operate on an opportunistic basis in the 42 GHz band without resulting in any interference to

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[31] *Id.* at 3.

[32] *See id.*

[33] *See id.*

[34] *Boeing Further Notice Comments* at 4-16.

UMFUS systems.[35] The Commission therefore has ample justification to reconsider (on its own motion or otherwise) its decision to refrain from creating an FSS allocation in the 42 GHz band.

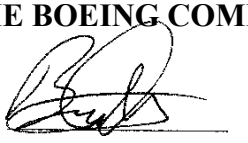
Given these facts, a justified need continues to exist for the Commission to adopt an allocation for FSS in the 51.4-52.4 GHz band and to designate the 50.4-51.4 GHz band as available for FSS pursuant to Section 25.202 of the Commission's rules. Substantial public interest benefits would result from such an allocation and, as Boeing has demonstrated, FSS systems could use the 50 GHz band to provide broadband services to consumers throughout the United States (and globally) on a shared basis with UMFUS systems.

IV. CONCLUSION

For the reasons stated herein, the Commission should create an FSS allocation in the 51.4-52.4 GHz band and modify Section 25.202 of its rules to identify the 50.4-51.4 GHz band as available for FSS Earth-to-space operations. The Commission should adopt these spectrally-efficient measures in the context of its concurrently pending Spectrum Frontiers proceeding.

Respectfully submitted,

THE BOEING COMPANY

By: 

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[35] *See id.* at 42-44.

CERTIFICATE OF SERVICE

I, Bruce Olcott, hereby certify that on this 1st day of November 2016, I caused copies of the foregoing Response of The Boeing Company to be placed in the U.S. Postal Service, first class postage paid, addressed to the following persons:

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